



I. T. Accessibility Toolkit

Developing Accessible Telecommunications

Version 1.0

Introduction

In November 2005, the Commonwealth of Virginia implemented the [Virginia Information Technology Accessibility Standard \(GOV 103-00\)](#). The Standard provides all State Executive Branch agencies and institutions of higher learning with the minimum accessibility requirements for procurement, development, or maintenance of electronic and information technology systems. The Standard also requires that Commonwealth of Virginia (COV) employees with disabilities and members of the public with disabilities have access to and use of information and data comparable to the access and use of Commonwealth employees and the public who do not have disabilities.

This document provides a guide to developing or purchasing telecommunications products and services that can be used by as many people as possible.

Access to Telecommunications

Accessibility means that products are available to and usable by the widest possible audience, including persons with disabilities. Accessible technology simplifies life for everyone, including elderly people and persons with disabilities, and the 0.5% of the population who are temporarily disabled through illness or accidents. Most accessibility features benefit all users.

Telecommunications policies have become critically important to people with disabilities because of the changes that have propelled society into an Information Age. The telephone as we have known it has been eclipsed by a multitude of devices, services, and options that are difficult to describe, not only because of their complexity but because of the constant changes and new developments in this area.

People with disabilities are more at risk of social and physical isolation than most other groups. Telecommunications technologies are vehicles for preventing, reducing and even eliminating that isolation. Telecommunications are an essential component of how Americans work, do business, socialize, take care of basic needs, and engage in the political process. It is difficult to imagine how one might function in American society without telecommunications.

For many people with disabilities, however, access to basic telephone service is still a challenge. People who are deaf, hard of hearing, or speech-impaired cannot use the voice-based telephone system. Telecommunications relay services are being developed that address some of these needs; yet they are a type of technical band-aid, requiring the user to first acquire an extra device ([Text Telephone](#), or telecommunications display device) and then communicate through an operator to another party. Many Text Telephones use [Baudot code](#), an extremely slow mode of transmission. Technologies are now emerging that could eventually replace this system.

There are non-technical barriers to telecommunications as well. For example, people who use Text Telephones have little assurance that they can communicate with government offices, even those that are listed as having Text Telephones. Government workers are often untrained in Text Telephone use and hang up the phone because they don't recognize the sound of a Text Telephone call.

For people who cannot read fine print or manipulate a phone book, the barrier is to information. Accessible forms of print information such as yellow pages directory services are not available. The resulting lost opportunities affect not only the person with a disability, who cannot easily find a plumber when the pipes break, for example, but the business that will never receive the call.

New and emerging telecommunications services and products such as voice processing, [videotext](#), and those associated with [automatic number identification](#) (A.N.I.) all present potential new barriers as well as the potential to be particularly useful to persons with disabilities. Voice processing refers to a range of information services that can be reached with a touch-tone phone. Videotext refers to interactive electronic services that are reached with a computer and a modem or a "dedicated" videotext terminal.

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A.N.I. is a technology that underlies new telephone services such as caller I.D., call blocking and call trace.

Overview of Voice over Internet Protocol (VoIP)

[Voice over Internet Protocol](#) (VoIP) is a new technology that provides an alternative to traditional telephone systems. Although VoIP has the potential to offer support for people with disabilities far beyond what is possible with a traditional telephone system, this potential is far from being realized. One reason for the lack of progress is that the Federal Communications Commission has exempted VoIP services from the Section 255 rules that require traditional telephone systems to be accessible to people with disabilities.

A more fundamental problem is that many traditional assistive devices - notably [teletypewriters](#) (TTYs) - rely on the telephone system's ability to transmit non-voice audio signals reliably and without distortion. This quality of transmission is not always possible in a VoIP network. To understand why this is the case, it is necessary to examine some of the basic differences between traditional telephone systems and VoIP systems.

Traditional telephone networks are "[circuit switched](#)." You can envision this by imagining that you have a dedicated set of wires between you and the person you're talking to. By contrast, VoIP telephone networks are "packet switched." You can envision this as being similar to the postal system. IP telephones break the user's voice stream into a sequence of individual packages called "packets," each of which contains a small recording (typically 20 milliseconds) of the person's speech. Each packet is tagged with information, including the address of the other person's telephone. As is the case with the postal system, the destination is specified for each packet, but the IP network chooses the routing. For example, for a VoIP call between Denver and DC, some packets may go via Dallas while others go via Chicago.

This flexibility in routing – along with the fact that many different types of data (not just voice) may be handled on IP networks – is one reason VoIP tends to be more economical than circuit switched telephone systems. But it can also cause problems – in fact, the same kinds of problems that occur in the postal system! For example, packets that are "mailed" in a specific sequence may arrive out of sequence; packets may be unintentionally routed via inefficient routes, causing them to arrive late; and packets may even be lost entirely and never arrive at the destination.

Most VoIP systems have voice-optimized packet loss concealment algorithms. In essence, these work by tricking the human ear into hearing something that wasn't there. For voice conversations, packet loss rates as high as 5% are usually tolerable. Unfortunately, if a TTY device does not receive the complete set of tones that comprise a character, it cannot be expected to display that character correctly. Another problem is that VoIP systems often use voice-optimized audio compression techniques in order to squeeze additional conversations onto the same set of wires. Some of these techniques can distort TTY tones so badly that the TTYs become unusable. The net result is that, although people can be pretty sure that communication will be reliable if they place the handset of a traditional telephone into the acoustic coupler of a TTY, there is no guarantee of TTY reliability if it's the handset of an IP telephone.

Although this may appear to be a gloomy picture, it is very important to keep in mind that the problems described above exist only when the voice channel of the VoIP connection is used to transmit non-voice signals, such as TTY tones. In light of these problems, why is VoIP regarded as having tremendous potential for increased accessibility?

A big difference between traditional telephony and VoIP is that, in a traditional analog phone system, all communication is carried on a single channel. This includes people's voices, as well as touch-tones, modem signals, and TTY tones. By contrast, a VoIP connection may consist of several parallel channels that do not interfere with each other, each carrying a different type of information. For example, text information can be carried reliably via "text packets" between IP telephones, at the same time that "voice packets" are carrying voice.

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Some VoIP system manufacturers have already implemented support for this type of approach, chiefly in order to compete for government contracts. Unfortunately, until the FCC applies the Section 255 rules to VoIP systems, people with disabilities should not assume that VoIP services – especially residential services – will be compatible with their traditional assistive technologies.

Technology Innovation

Technology has opened up the workplace and created a more level playing field for the disabled. The disability community has the highest rate of unemployment or underemployment of any constituency. Technology enhances their ability to find meaningful employment. Over half of the fortune 500 companies are deploying VoIP phones and over 10,000 organizations have deployed the technology with millions of IP phones acquired. VoIP is becoming a mainstream technology.

Traditionally, voice traffic is carried via circuit-switched networks ([private branch exchange](#) [PBX] networks) or networks made up of private lines and [time division multiplexers](#) (TDM's). Data networks have traditionally been separate from these voice networks. VoIP offers the possibility of a converged network which integrates data, voice, and video onto a single IP-based network. This technology offers significant operational and productivity benefits.

- Reduced operational expenses - A converged IP network reduces the number of networks to manage.
- Unified messaging capability - Users can send and receive faxes from their desks and reply to e-mails by phone.
- Mobility - Home, branch, roaming, and traveling workers can access the same features as those working at corporate offices. Roaming users can even keep the same phone number by using the IP phones.
- Extensible Mark-up Language (XML) applications - These allow third parties to create value added-applications (e.g., time cards) on the IP phones.
- A standards-based, non-proprietary solution - Unlike traditional voice solutions, VoIP is based on non-proprietary protocols and is built using industry standards. This open interface means that organizations are not dependent on their PBX vendor to develop needed special applications or features. Instead, they can deploy a third party vendor who has the application that meets their needs today. Organizations with accessibility requirements can then mix and match the best-of-breed applications and use different vendors to suit their end-user needs.
- Architecture - allows the reliable transportation of TTY services through the network.

In the face of challenges such as employee retention, cost savings and increased productivity, organizations are continually pressed to look for innovative ways to streamline business operations while boosting effectiveness. Accessibility is one area that provides insight into what makes an organization productive, and steers inventions essential to meeting standards and enhancing user experience — to arrive at innovation that benefits everyone.

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Table - Accessibility Features: VoIP and Related IP-enabled Applications

	Deaf	Hard of Hearing	Blind	Low Vision	Speech Impaired	Dexterity Impaired	Cognitively Impaired
Integrated, simultaneous voice, text, and video communication, wired and wireless	Sign language communication Easier set up and use of voice carryover Easier set up and use of video relay Captioned video-conferencing	Speech-reading Captioned video-conferencing			Easier set up and use of hearing carryover Improved speech-to-speech using video	Improved ease of use with wireless	More compelling and intelligible communication with multiple media
Integration with IP-based TRS (relay)							
Wideband audio (better audio quality)		Improved intelligibility			Improved intelligibility		
Full-featured two-way simultaneous text communication (full screen, fonts, emoticons, etc.)	Easier to use, more expressive than TTY				Easier to use, more expressive than TTY; easy to prepare utterances in advance and insert into message		
User profile automatically establishes individual preferences and network services (transcoding, relay, text macros, speech synthesis, etc.)	Easier set up	Easier set up	Easier set up	Easier set up	Easier set up	Easier set up; reduced physical effort	Easier set up; reduced mental effort Buddy list simplifies use

Reliable Transmission of TTY over IP

With standard analog telephone service that resides in many homes and offices, all communication is via transmissions carried on a single audio channel, including the caller's voice, touch-tones and modem signals. TTY's and other traditional assistive technologies rely on the telephone system's ability to transmit audio information reliably and without distortion. In contrast to an analog environment, VoIP audio channels (i.e., the mechanisms by which VoIP systems transmit voice) are not required to support reliable TTY communication. A significant problem is that the voice-optimized audio compression commonly employed in VoIP environments can decrease TTY accuracy so that TTY becomes unusable.

Communication for All

The telephone is one of the main tools of our everyday life. In our homes the telephone provides easy access to the outside world. For many people it is their main link with others. This is particularly so for disabled and elderly people; however, the telephone can be a barrier to communication if it is difficult to use.

- According to the 2000 Census, there are over 281 million people in the United States; more than 20% have functional disabilities. Over 56 million people with functional disabilities in the U.S. earn 1.2 trillion dollars in income and have over 200 billion dollars in annual discretionary income.
- While there is still a high degree of unemployment among people with disabilities, there is an increase in the number of people with disabilities graduating from major universities and training programs and entering the job market.
- 60 million baby boomers are expected to leave the workforce in the next 15 years. Without strategies to attract or retain workers, companies will face a significant loss in knowledgeable workers.
- Many workers over the age of 60 will face some degree of difficulty in using telecommunications equipment if it is not accessible.

Elderly and disabled people form a very significant portion of the telecommunications market, a proportion with increasing disposable income. Americans are staying and are planning to stay in their jobs beyond the age of 65. As the general workforce continues to age, the incidence of disabilities (for example low-vision, arthritis) increases, forcing organizations to adapt to their employees ongoing physiological changes. Accessible technology aids organizations as they establish strategies to hire, develop, retain and transition their valuable knowledgeable workers.

Essential Telecommunication Features

Many disabled and elderly people have difficulty using telephones. For example, buttons can be difficult to distinguish and some telephones can be difficult to hold without accidentally pressing the keys. The huge range of telephones in all shapes and sizes that come packed with features can present problems for even the most able user.

This section outlines features that can improve accessibility to disabled people when added in selected combinations to a telephone terminal. The features are matched against disability groups with an explanation of the way the features can improve access.

Most of the features described below are generally regarded as desirable options, but for many disabled and elderly people they are essential to telephone access. If legislation drives the provision of telephones that are accessible to people with disabilities, and the accessibility features have not been built in, replacement of equipment could be expensive and disruptive for those under obligation to comply. For manufacturers, the high cost of retrofits to existing designs makes it wise to consider accessibility requirements as early as possible.

Table - Essential Telecommunication Features

Feature	Definition	People with these Disabilities Would Benefit...
Additional Earphone	<p>This feature enables a second earphone to be connected, enabling a user to listen with both ears.</p> <p>The additional earphone can also be used by a hearing helper who can repeat the message so that it can be lip read, or use sign language to convey the message.</p>	<p>Hearing impairment – moderate</p> <p>Hearing impairment – severe</p> <p>Deafness</p> <p>Deaf-blindness</p> <p>Cognitive impairment</p>
Coupling to a Computer	<p>Coupling to a computer is a feature which allows deaf and deaf-blind users to use their personal computers as text terminals. It enables use of dial-out software and personal electronic phonebook database. It also allows people with very severe physical disabilities to access the telephone through ordinary terminals, and allows severely speech-impaired users to connect their communication aids.</p>	<p>Deafness</p> <p>Deaf-blindness</p> <p>Speech impairment – severe</p> <p>Limited use of hands/arms</p> <p>Weak grip</p>
Dial Out Buffer Memory	<p>A dial-out buffer memory enables users who are slow in dialing to avoid being timed-out. Generally the user taps in a number and when ready presses a send key, as used on many mobile phones. Many elderly people need plenty of time to read a number, press the keys and check that they have entered the correct number.</p> <p>It is recommended that the buffer memory also include a system to remind the user if a process has not been completed.</p>	<p>Deafness</p> <p>Visual impairment – severe</p> <p>Blindness</p> <p>Deaf-blindness</p> <p>Limited dexterity</p> <p>Limited use of hands/arms</p> <p>Weak grip</p> <p>Hand tremor</p> <p>Cognitive impairment</p>
Enlarged Keys	<p>Enlarged keys enable persons with poor dexterity to press the correct key. A concave shape to the keys also helps fingers to stay in place.</p> <p>Large clear typefaces should be used to improve legibility for persons with low vision and provide enough space for Braille.</p>	<p>Visual impairment – moderate.</p> <p>Visual impairment – severe.</p> <p>Blindness</p> <p>Deaf-blindness</p> <p>Limited dexterity</p> <p>Limited use of hands/arms</p> <p>Weak grip</p> <p>Hand tremor</p>
Full Video Facility	<p>Terminals that can display sign language or permit lip-reading is especially valuable for users with severe hearing difficulties. Sign language has its own grammar and syntax</p>	<p>Hearing impairment – severe.</p> <p>Deafness</p> <p>Cognitive impairment</p>

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Feature	Definition	People with these Disabilities Would Benefit...
	and is regarded as a language in its own right, so those who use it may regard written English (ie. Text) as foreign. This group of users, which includes many of those who were born deaf, will not be well served by the telephone network until high definition video telephony is readily available.	
Guarded/Recessed Keys	When a person has difficulty making precise finger movements, large keys that are recessed or guarded can help ensure that the wrong key is not pressed.	Visual impairment – severe. Blindness Deaf-blindness Limited dexterity Limited use of hands/arms Weak grip Hand tremor
Hands-Free Operation	Hands-free operation is valuable for users with severe upper limb impairments, but it must include the call set-up procedures.	Limited dexterity Limited use of hands/arms Weak grip Cognitive impairment
Handset Easy Grip	To help people with uncoordinated movement or reduced strength in their hands, it is important that there is enough space for fingers between the handset and the telephone base unit so that it can be picked up and replaced with ease. The way the handset is positioned on the base unit can also make a big difference in how easy it is to pick up. The handset and the way it rests on the base unit should be designed so that the handset falls easily back into place and cannot be positioned incorrectly.	Limited dexterity Limited use of hands/arms Weak grip Hand tremor
Handset – light weight	People with reduced strength in their arms and hands can find it difficult to lift and hold a handset if it is too heavy or if the balance of weight is uneven. In particular it can be uncomfortable and require extra strength to hold a handset if the earpiece is heavier than the mouthpiece. Balance, weight, shape and size are all important aspects as well as the balance of weight between the earpiece and the	Limited dexterity Limited use of hands/arms Weak grip Hand tremor

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Feature	Definition	People with these Disabilities Would Benefit...
	mouthpiece.	
Handset – ergonomic shape	The shape and size of the handset are very important factors. People with arthritis, uncoordinated movement or reduced strength may find it difficult to handle and hold the handset if the shape is too rounded and smooth or if it is too wide or too small. Consideration should also be given to the functional shape of the handset when it is being held to the ear by a person with reduced coordination or weak grip.	Limited dexterity Limited use of hands/arms Weak grip Hand tremor
Handset – plug connected	For some people the features that can be included on a telephone will not solve the problems they encounter using a telephone. Plug connection of the handset permits the use of alternatives such as a lightweight headset, which may be very convenient for those who have to use head pointing devices to compensate for absence of arm movement. It also allows for extended cords to be fitted, so that the handset can be mounted on a fixed stand. New telephones should be designed to allow connection to a range of additional devices.	Hearing impairment - severe Limited dexterity Limited use of hands/arms Weak grip
Handset – noise excluding	Conventional noise-excluding techniques are probably inappropriate in ordinary consumer terminals, but it is still possible to limit the adverse effects of ambient noise through careful handset design. In particular it is important that the earpiece is large enough and shaped to cover most of the ear. This helps seal the ear to reduce external noise interference for persons with reduced hearing.	Hearing impairment - moderate Hearing impairment - severe
Hearing Aid Compatibility	To be hearing-aid compatible a terminal must be able to work in conjunction with a hearing aid without mutual interference and with minimal change to the setting of the hearing aid.	Hearing impairment - moderate. Hearing impairment - severe
High Contrast Display	Many telephones use small text displays that show dark characters on a mid-tone background. This is very difficult to read for most people with low vision. It is very important to display text and	Visual impairment - moderate Visual impairment - severe

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Feature	Definition	People with these Disabilities Would Benefit...
	<p>numbers in a way that provides maximum contrast between the characters and the background.</p> <p>Pale colors and colors which are close in tone should be avoided.</p> <p>White or yellow type on black or a dark color is more legible provided the typeface weight and size are suitable. Small type and very bold type tend to blur for some people, reducing legibility.</p>	
Key Feedback – Tactile	Tactile feedback that confirms a key has been pressed can be very helpful. Keys with a detectable physical change in indentation can provide a tactile signal.	<p>Hearing impairment - severe</p> <p>Deafness</p> <p>Deaf-blindness</p> <p>Limited dexterity</p> <p>Limited use of hands/arms</p> <p>Weak grip</p> <p>Cognitive impairment</p>
Key Feedback – Audible	<p>For many people some form of audible confirmation that a key has been pressed is very helpful. This will normally take the form of a sound in the telephone earpiece when a key is activated.</p> <p>Audible feedback is particularly helpful to blind and visually impaired people, but also helps people with poor manual dexterity who may not be sure if they successfully activated a keystroke.</p>	<p>Visual impairment - moderate.</p> <p>Visual impairment - severe.</p> <p>Blind</p> <p>Speech impairment - moderate</p> <p>Speech impairment - severe</p> <p>Limited dexterity</p> <p>Limited use of hands/arms</p> <p>Weak grip</p> <p>Hand tremor</p> <p>Cognitive impairment</p>
Key Feedback - Displayed	Users with impaired hearing may require a displayed indication of dialing. This feature is vital for those with physical difficulties who miss or inadvertently repeat a digit.	<p>Hearing impairment - severe</p> <p>Deafness</p> <p>Limited dexterity</p> <p>Limited use of hands/arms</p> <p>Weak grip</p> <p>Hand tremor</p> <p>Cognitive impairment</p>

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Feature	Definition	People with these Disabilities Would Benefit...
Key Pressure - Selectable	<p>The operating pressure required to activate a key may be critical for some people.</p> <p>Unsuitable pressure may result in incorrect keying, either through no contact or repeated operation.</p> <p>A means of adjusting the return spring pressure or, alternatively, a range of keypads with differing operating forces, is required to meet the needs of these users.</p>	<p>Deafness</p> <p>Visual impairment - moderate</p> <p>Visual impairment - severe</p> <p>Blindness</p> <p>Deaf-blindness</p> <p>Cognitive impairment</p>
Large Character Display	<p>Good standards of legibility help all users, but for many people with low vision the issue is fundamental to being able to read text displays.</p> <p>Displays that enable large characters to be shown are essential to persons with visual impairment.</p>	<p>Visual impairment - moderate</p> <p>Visual impairment - severe</p>
Microphone Amplification	<p>A telephone with a sensitive microphone helps persons with quiet voices or with restricted neck and chest movement that makes speaking difficult. It is also important for the user to be able to adjust the sensitivity of the microphone so that it can be used by either a person with a weak voice or a normal voice.</p> <p>Amplification of the microphone should be user controlled and should reset on call termination.</p>	<p>Speech impairment - moderate</p> <p>Speech impairment - severe</p>
Non-slip Base	<p>For people with uncoordinated movements, it is very important to have a telephone that remains steady when they lift or replace the handset and when buttons are being pressed. To meet this requirement a telephone must have some form of non-slip base or pads. There is also a correlation between the weight of the telephone and the type of non-slip base required.</p> <p>A non-slip base is a desirable feature on any telephone which is not designed exclusively for fixed mounting. Fixing points which are provided for wall-mounting should, where appropriate, allow for mounting on a horizontal surface for users who require a steady terminal.</p>	<p>Deafness</p> <p>Deaf-blindness</p> <p>Speech impairment - severe</p> <p>Limited dexterity</p> <p>Limited use of hands/arms</p> <p>Weak grip</p> <p>Hand tremor</p>
Plug-In Keyboard	For many people with disabilities it is	Deafness

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Feature	Definition	People with these Disabilities Would Benefit...
	important to be able to connect an external keyboard. This enables them to set up a range of customized systems such as the feature to use specialized controls.	Blindness Deaf-blindness Limited dexterity Limited use of hands/arms Weak grip Hand tremor
Plug-In Display	A socket to permit the connection of an external display with a standard interface would permit users with special needs to connect their own assistive technology.	Deafness Visual impairment - moderate Visual impairment - severe Blindness Deaf-blindness Cognitive impairment
Receiver Amplification	Receiver amplification enables the user to increase the volume of sound coming through the telephone earpiece. This is helpful to people who either do not have a hearing aid or who need to remove their hearing aid to use the phone. This feature should allow for increasing the level of the acoustic output by user adjustment. For safety reasons it is recommended that the control should reset to zero on termination of a call.	Hearing impairment - moderate Hearing impairment - severe
Ringer Pitch Adjustable	People with a hearing loss that is significantly frequency-dependent may need to be able to shift the dominant tone of the ringer into a region where their hearing acuity is higher. This is particularly important where high-pitched ringers are used, since the most common forms of hearing impairment disproportionately affect the higher frequencies.	Hearing impairment - moderate Hearing impairment - severe
Ringer Volume Adjustable	The maximum output level from the ringer should provide good audibility even in domestic environments where acoustic absorption may be high, requiring a means of controlling the output. Only with more severe forms of hearing loss should it be necessary to utilize separate high volume	Hearing impairment - moderate Hearing impairment - severe

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Feature	Definition	People with these Disabilities Would Benefit...
	ringing devices or visual signalers.	
Speech Input Keying	<p>Speech-input keying is a useful means of providing a hands-free call set-up for users with reliable voice, and may be valuable even where full hands-free operation is not necessary (e.g. when hand tremor interferes with manual keying). It is useful for dyslexic users who can read aloud and simultaneously dial a number thus avoiding short-term memory problems.</p> <p>Such systems could be limited to just the numerals or a few words such as 'doctor' or 'Jane'.</p>	<p>Limited dexterity</p> <p>Limited use of hands/arms</p> <p>Weak grip</p> <p>Hand tremor</p>
<u>Sidetone</u> Reduction	<p>This is a feature for improving the signal to noise ratio at the earphone by minimizing the effects of ambient noise picked up by the microphone and mixed with the incoming speech.</p> <p>The sidetone level should be user-adjustable within the limits set by the network characteristics.</p>	<p>Hearing impairment - moderate</p> <p>Hearing impairment - severe</p> <p>Speech impairment - moderate</p> <p>Cognitive impairment</p>
<u>Smart Phone</u> – Auto Adjust	The technology that is developing around smart cards enables a user to store their own preferences on the memory chip of a smart card. Smart-card-based telephones allow a user's card to instruct the telephone to make specific adjustments. This could be adjustments to sound quality, volume, typeface sizes, language and preferences.	<p>Visual impairment – moderate.</p> <p>Visual impairment – severe</p> <p>Deafness</p> <p>Deaf-blindness</p> <p>Speech impairment – moderate</p> <p>Speech impairment – severe</p> <p>Cognitive impairment</p>
Standard Key Layouts	<p>People who are blind and persons with low vision have difficulty reading the labeling on keys. It is important that the layout of keys be kept in a standard arrangement.</p> <p>It is also important to set out the keys in a way that makes it easy to distinguish between the main numerical keys and other function keys. Variation in the size, shape and position of function keys will help differentiation.</p>	<p>Visual impairment - moderate</p> <p>Visual impairment - severe</p> <p>Blindness</p> <p>Deaf-blindness</p> <p>Cognitive impairment</p>

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Feature	Definition	People with these Disabilities Would Benefit...
Synthetic Speech Display	<p>A more convenient way of presenting display messages for those people who have difficulty reading them is to make use of synthetic speech. A means of adjusting volume, and of initiating or repeating the message, will be required.</p> <p>Poor quality synthetic speech can be difficult to understand by those with a mild hearing impairment.</p>	<p>Visual impairment - moderate.</p> <p>Visual impairment - severe</p> <p>Blindness</p> <p>Cognitive impairment</p>
Tactile Display	<p>Visual displays, such as last number dialed or caller line identification, cannot be read by people who are blind or have severe visual impairment. A line of Braille cells will provide a tactile display of this information and, because only a limited amount of data is ever shown, high proficiency in Braille is not required. It may be convenient to provide for an external Braille device to be connected (see Plug-in display).</p> <p>The Braille display repeats the information on the visual display (e.g. caller line identification).</p>	<p>Visual impairment - severe</p> <p>Blindness</p> <p>Deaf-blindness</p>
Tactile Key Markers	<p>Persons who are blind or have low vision find it useful to be able to feel the keys of a telephone. It is particularly important to have a single raised dot on the number 5 key.</p>	<p>Visual impairment - moderate</p> <p>Visual impairment - severe</p> <p>Blindness</p> <p>Deaf-blindness</p>
Text Send – Keyboard	<p>Text send (keyboard) is a feature required by people who are deaf, deaf-blind and those who have severe speech impairment. It must be accompanied by a feature to display the incoming text (and network messages).</p> <p>The features may be combined in a dedicated terminal (a Text phone), added to a public payphone or associated with a personal computer (especially for those who are deaf blind).</p> <p>The keyboard should have a standard layout and not limit the speed for a good typist.</p>	<p>Deafness</p> <p>Deaf-blindness</p> <p>Speech impairment - severe</p>
Text Display – Tactile	<p>For persons who are deaf-blind the display must be tactile (e.g. Braille). The Braille</p>	<p>Deaf-Blindness</p>

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Feature	Definition	People with these Disabilities Would Benefit...
	display is often connected to a computer which can be connected to the telephone. A user who is deaf-blind needs all functions (e.g. line status) available tactually.	
Text Display – Visual	<p>Visual displays of text must be legible even under adverse lighting conditions; visual (or tactile) indications of line status are essential.</p> <p>A line by line presentation is often preferable to a single line of scrolling text.</p> <p>Although visual display of text and line status is not automatically required for people with severe speech impairment, it will often be the case that the speech difficulty is associated with deafness. Also, these features are usually associated with text telephones, which provide the keyboard-send feature.</p>	<p>Deafness</p> <p>Speech impairment - severe</p>
<u>VDU Text Adjustable</u>	<p>Terminals which offer a full display of text on a visual display unit should allow adjustment of the size of the characters. The characters must also be of good proportions with clear character shapes. There must also be a strong contrast between the characters and the background.</p> <p>For some visual impairment it is also helpful to be able to reverse the text from dark on a light background to light characters on a dark background.</p> <p>The display screen should be capable of positional adjustment to avoid any reflected light.</p>	<p>Deafness</p> <p>Visual impairment - severe</p>
Visual Contrast Key Legends	<p>Large clear typefaces should be used to improve legibility for persons with low vision. When choosing typefaces it is important to use characters that have clear 'open' shapes. Many people with low vision can easily misread such characters as 3, 5, 6, 8 and 9 if the tails curl over, which tends to blur or merge the shapes.</p>	<p>Visual impairment - moderate</p> <p>Visual impairment - severe</p>
Visual Line Status Display	<p>A visual display of the line status is essential on Text Send terminals for people who are deaf, and is desirable on any terminal for use by those with a severe</p>	<p>Hearing impairment - severe</p> <p>Deafness</p>

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Feature	Definition	People with these Disabilities Would Benefit...
	hearing impairment.	
Visual Ringing Signal	<p>For persons who are deaf or have a severe hearing impairment it is essential that they can see some form of visual signal for incoming calls.</p> <p>Visual signals incorporated in the terminal are not easily seen and are mainly of use as a reminder of line status. Socket connections should be provided so that external indicator lights can be powered from the terminal, either directly or from the main supply through a relay. Alternatively, systems which cause the domestic lights to flash can be used.</p> <p>Vibrating pagers are an alternative to flashing lights.</p>	<p>Hearing impairment - severe</p> <p>Deafness</p>

Telecommunications Access Opportunities

For individuals with limitations in hearing, seeing, moving, speaking, or cognition, the explosion of telecommunications offers opportunities as never before.

New technology has the capability of "speaking" for people with speech disabilities and "hearing" for people who are deaf. It can bring information and education into homes and workplaces for people who have mobility limitations. It can provide added cues and reminders for people with memory or cognitive loss. Overall, it can help support a web of communication that makes it easier for people with disabilities to stay integrated in society.

Equal Access is good for Business

Accessible design maximizes the number of potential customers and employees who can readily use a product. Making products easy to use can increase market share by enabling people with disabilities and functional limitations to enjoy consumer electronic products.

To maximize the number of users for each product, companies should consider the needs of consumers with visual impairment, including those who are blind; consumers with hearing impairment, including those who are deaf; and consumers with mobility and speech impairment.

Providing equal access through communications to users with special needs provides opportunities for enterprises to:

- Access a large, talented labor pool from which they can draw; and
- Engage an untapped customer base with tremendous discretionary income.

Implementing accessible telecommunications technology ensures compliance with the recent Commonwealth of Virginia [Information Technology Accessibility Standard](#) as well as federal equal access laws, regulations and standards. This level of standards compliancy delivers equal access to all

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employees, business partners and customers, regardless of physical limitations, and reduces the risk of litigation.